NTRIP SERVICE IN ARGENTINA

Diego Piñón, Sergio Cimbaro, Demián Gómez
Argentine National Geographic Institute

ABSTRACT

The NTRIP protocol has gained great importance worldwide due to the high precision that it offers and the low operating costs it involves.
The NTRIP service provided by the Argentine Geographic Institute (IGN) is based on a Continuously Operating Reference Stations Network called RAMSAC. This network currently has 43 GNSS Reference Stations, of which, 17 generate real-time corrections that are distributed by the NTRIP protocol. Many of the stations that form part of the RAMSAC network, belong the IGS and SIRGAS network, contributing to the RNAAC of the IGS (Associated Regional Analysis Center for SIRGAS).

This service works with SIRGAS-RT, whose main objective is to investigate and distribute real-time applications for the region. Additionally, it allows the study of ionospheric behavior in the region, and sets up a Ground Based Augmentation System (GBAS) to provide real time corrections to various applications such as precision agriculture, as well as air, sea and land navigation.
This display shows the tools that have been developed to monitor the service, after the installation of the professional NTRIP Caster developed by the BKG (Federal Agency for Cartography an Geodesy). These tools verify the number of users accessing, the mean streaming latencies measured with a cesium standard. This paper also shows the scope of the service and its possible future applications.

NTRIP PROTOCOL

NTRIP (Network Transportation of RTCM via Internet Protocol) is a HTTP protocol for real-time positioning. RTCM SC-104 protocol was developed by the Radio Technical Commission for Maritime Services, and it has become one of the standards used for real-time positioning.

NTRIP protocol is aimed at those users who practice the following methods:
- RTK (real time kinematic):
Uses carrier phase. The distance between satellite and receiver is measured calculating the number of cycles (ambiguities).
Receivers types: Double and single frequency.
Accuracy: Centimeters. The reference station must be within a distance of 50 kilometres for dual-frequency receivers, and 20 km for single-frequency receivers.
- DGPS (Differential GPS):
Uses signal travel time between satellite and receiver to calculate the distance between them.
Receivers types: Double and single frequency receivers and code receivers.
Accuracy: 1 to 5 meters. The reference station must be within a distance of 500 kilometres.

The NTRIP System Components
- NTRIP Servers:
Continuous Operation Reference Stations (CORS) generate the corrections and transmit them using RTCM protocol. RTCM versions currently generated by the Argentine CORS network are 2.3 and 3.0 depending on the GNSS receiver.
Corrections are generated based on the known coordinate of each permanent station.
- NTRIP Caster:
The corrections generated by the CORS are sent via Internet (HTTP) to a server named NTRIP Caster.
- NTRIP Clients:
Users wishing to receive the corrections should access the NTRIP Caster via the Internet. This way, users may use the service through external devices such as notebooks, PDAs or phones (GPRS, 3G). These devices are then responsible for receiving corrections from the NTRIP Caster and sending them to the GNSS receiver (via cable or Bluetooth connection) to apply the corrections or do real time positioning.

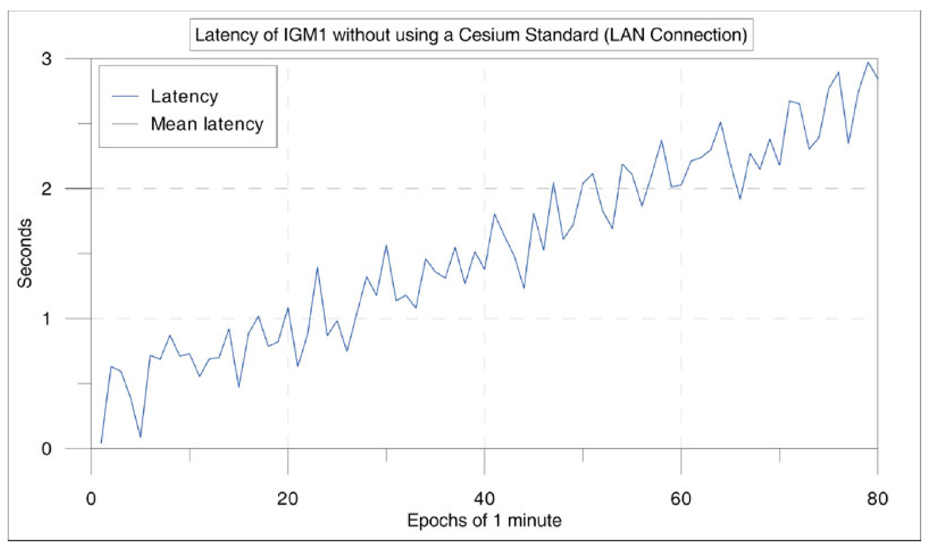
RAMSAC-NTRIP

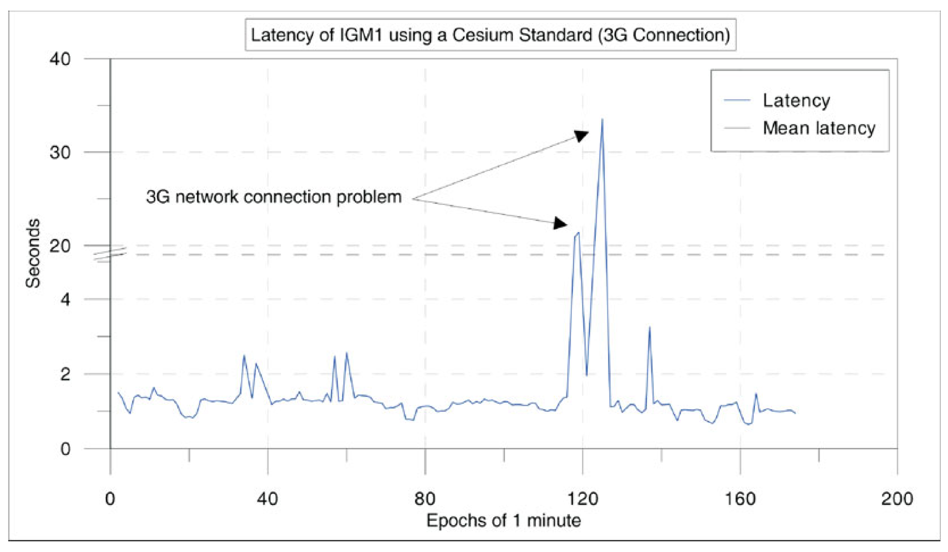
SERVICE ACCESS

The **Professional BKG NTRIP Caster** was installed on a server located in the National Geographic Institute building in Buenos Aires.
The Terrestrial Reference Frame of Argentina is called POSGAR 07, and it is based on the ITRF05- IGS05 solution at 2006.632 epoch.
To access the service:
Address: **190.220.8.208**
Port: **2101**
Webpage: **http://www.ign.gob.ar/Introduccion_Ramsac-ntrip**
Contact Information: Diego Alejandro Piñón **dpinon@ign.gob.ar** - Sergio Rubén Cimbaro **scimbaro@ign.gob.ar** - Demián Gómez **dgomez@ign.gob.ar**

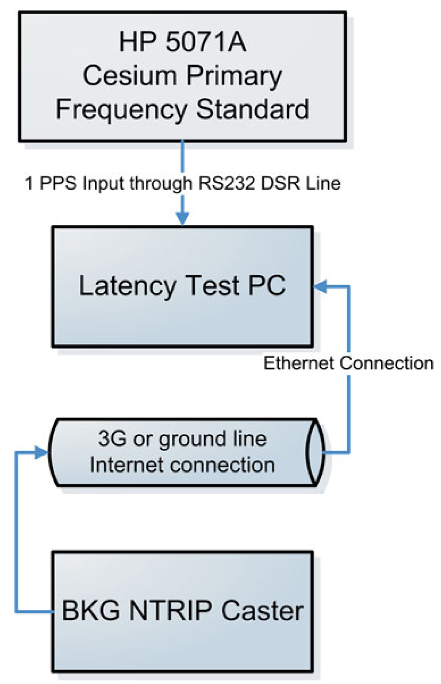
LATENCY

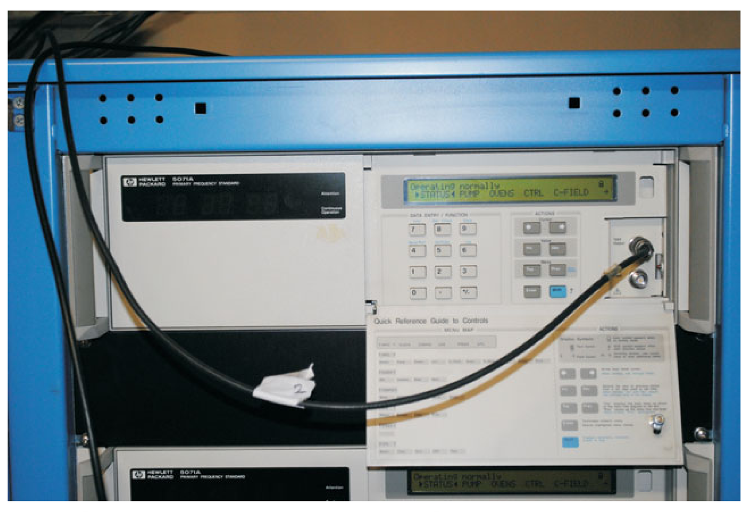
RTCM messages from the Argentine CORS network are generated and sent to users with a frecuency of 1 Hz. Latency refers to the time elapsed between the generation of corrections in the CORS and its implementation on the rover. It is recommended that this time does not exceed 2 seconds.
Two latency tests were performed to control the latency of the corrections: one with a ground line Internet connection, and one with a wireless 3G connection.
Software was developed using .NET Framework in order to monitor the RTCM latencies. This software calculates latencies by comparing the modified z-count in RTCM messages to the internal clock of the PC. In order to have a stable time reference, the clock of the PC was synchronized using the 1PPS signal of the IGN's cesium standard at the IGNA time laboratory, where UTC(IGNA) is kept. Without this procedure, the latency readings would have been affected by the normal walk of the unstable PC clock.

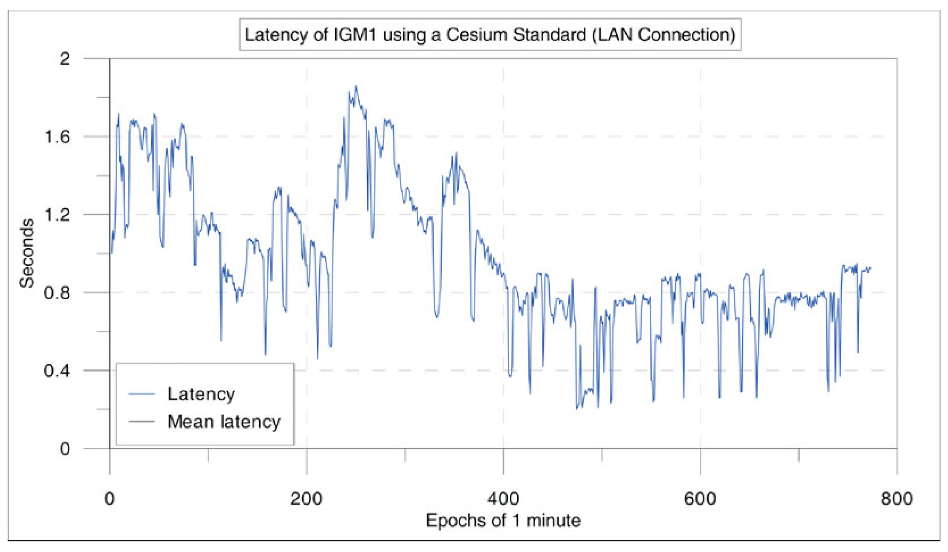





1 PPS output

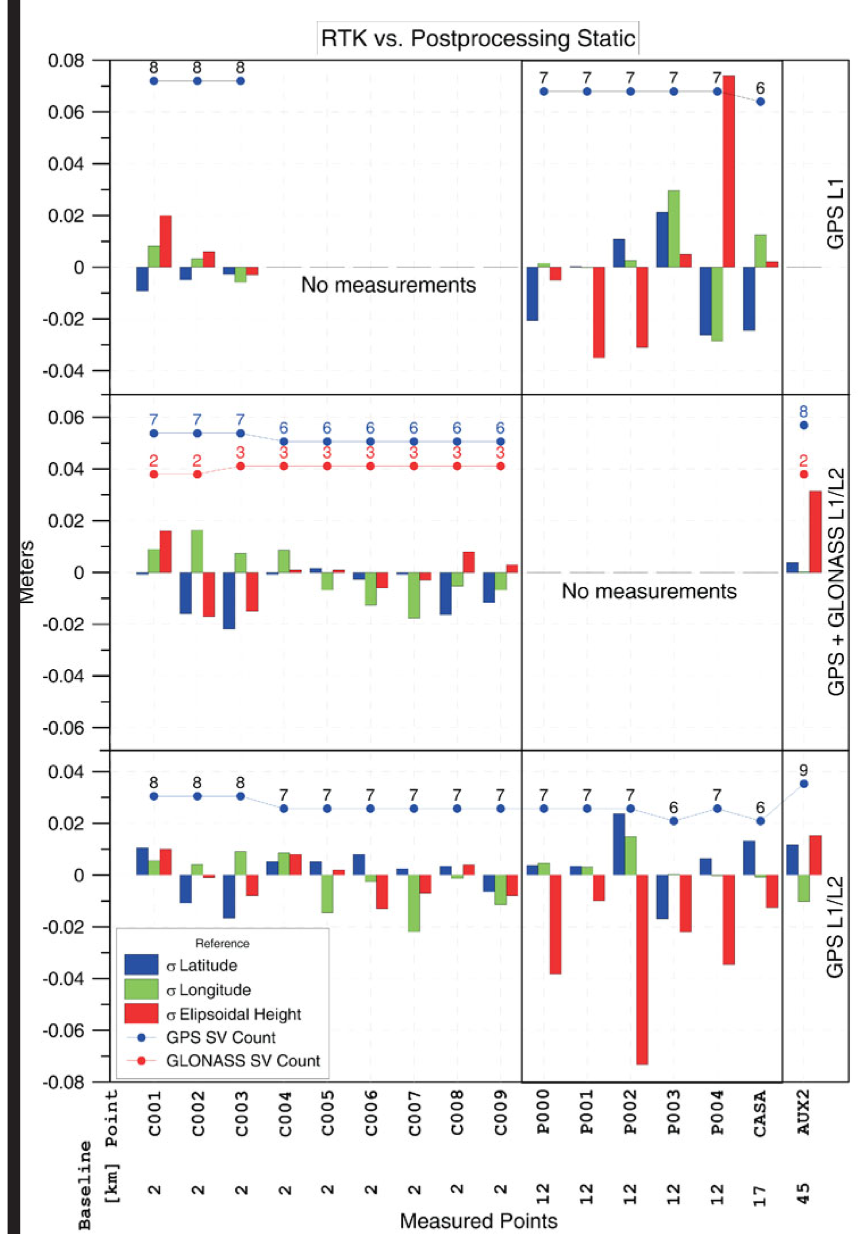



Cesium Primary Frequency Standard HP5071A



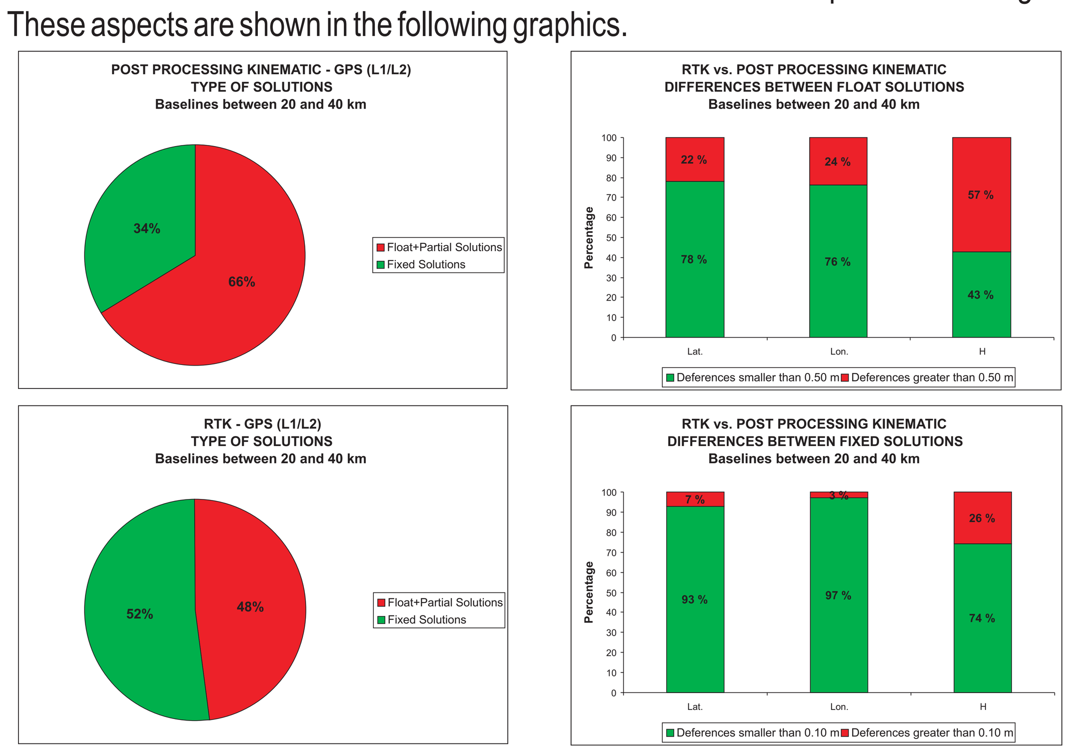
TEST MEASUREMENTS

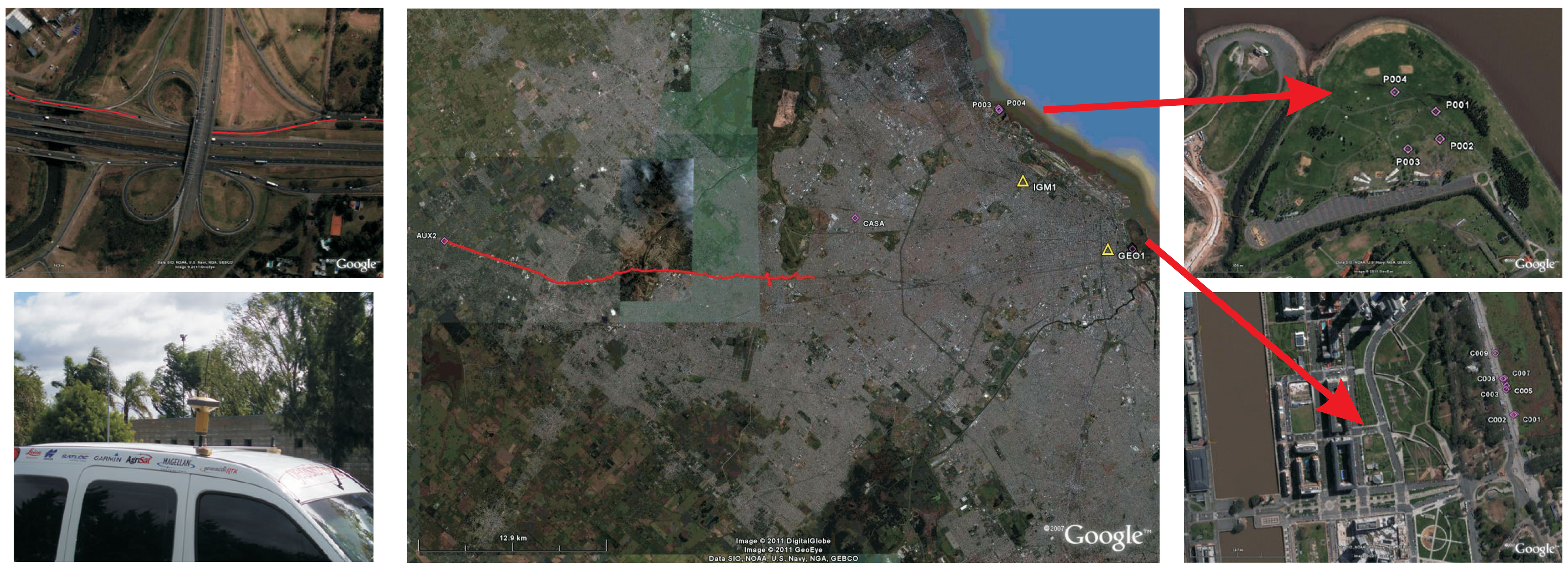
Test measurements were performed in order to determine the accuracy of the corrections and the service performance of the Caster.



RTK vs. POST-PROCESSING STATIC
The main purpose of this test was to compare the coordinates of 17 benchmarks obtained from the post-processing static method with those obtained from RTK method.
Post-processing static positions were calculated from 2 hours measurements using an L1/L2 GPS receiver. Baselines were adjusted using 2 CORS (IGM1 and GEO1).
RTK positions were calculated using different types of receivers as rovers: L1 GPS, L1/L2 GPS and L1/L2 GNSS. RTK solutions were always fixed. Corrections used were RTCM version 3.0, form the GEO1 mountpoint of the RAMSAC-NTRIP Caster.
The following chart shows the differences between the positions obtained from post-processing static measurements and RTK measurements.

RTK vs. POST-PROCESSING KINEMATIC
An L1/L2 GPS receiver was mounted on the roof of a car. The GPS simultaneously registered RINEX data and RTK positions during two hours. The distance reached from the CORS was approximately 40 km. Post-processing kinematic positions were calculated and adjusted using 2 CORS (IGM1 and GEO1). RTK positions were calculated using RTCM 3.0 corrections from the GEO1 mountpoint of the RAMSAC-NTRIP Caster.
The main objectives of the test were to determine the accuracy and the performance of the service based on the following criteria:
- Amount of fixed, partial and float solutions using both measurement methods.
- Differences between RTK and post-processing kinematic positions in the cases where both solutions were fixed and in the case where both solutions were partial or floating.
These aspects are shown in the following graphics.





GOALS

1- To enable and distribute free RTCM corrections for all the Argentine CORS (currently 43).
2- To generate a VRS service for Argentina.
3- To conduct ionospheric research in Argentina.

FINAL COMMENTS

It is possible to obtain accuracy within centimetres when the device is positioned in places where the Internet is available, while the distance between the CORS and the rover does not exceed 50 km.
As long as communications infrastructure continues to grow in Argentina, it is anticipated that NTRIP users will also increase significantly.